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Digital Release of Stream-Sediment, Heavy-Mineral-Concentrate, and Other Geochemical Data Collected in the Circle 1° x 3° Quadrangle, Alaska

By

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INTRODUCTION

The historic geochemical data presented here were compiled from the Rock Analysis Storage System (RASS) of the U.S. Geological Survey National Geochemical Database (NGDB). The RASS database consists of multi-element chemical and spectrographic analyses for approximately 700,000 geochemical samples collected from the mid-1960's to the late 1980's.

Reconnaissance geochemical sampling and analysis was conducted in the Circle quadrangle in the 1980's as part of the Alaska Mineral Resource Assessment Progam (AMRAP). Although collected primarily for mineral resource studies these geochemical data may be useful for environmental or other mineral resource studies in the region. The purpose of this report is to release these data in a more modern, easy-to-use format. While compiling the data for this report, sample coding and geochemical data were inspected and gross errors were corrected. Most of the chemical data included in this report were previously published in hard-copy format, generally without the sample coding information provided here. Previous data reports for the Circle quadrangle include Bailey and others (1987), Cathrall and others (1988; 1991), O'Leary and others (1986), Sutley and others (1987), and Tripp and others (1986).

The Circle quadrangle is bounded by latitude 65° N to 66° N and longitude 144° W to 147° W. The analytical results for 1,630 stream-sediment, 1,140 heavy-mineral-concentrate, and 33 organic samples are given in this report. The data files included on this diskette are separated by sample media type. All data files are in dBase III .dbf format. The first three letters of the filename refer to the quadrangle. Letters following the underscore refer to sample media: CONC, heavy-mineral concentrates; SED, stream sediments; and ORG, organic samples.

METHODS OF STUDY

Sample Media

The chemical composition of stream-sediment samples reflects the overall chemistry of rocks contained within the drainage basins. Such information is useful in identifying those basins which contain concentrations of elements that may be related to mineral deposits. Moss-trap sediments represent eroded material in the active stream channel. These samples are similar to stream-sediment samples and were collected in some areas containing thick loess cover (Sutley and others, 1987).

Heavy-mineral concentrates from stream sediment are selectively enriched in certain minerals, including many that may be ore-related. This concentration process permits detection of some elements that are not easily or reliably detected in bulk stream sediment.

Organic sample media generally refer to vegetation samples collected from specimens growing in the flood plains of a stream or river. These samples were usually collected at or near a corresponding stream-sediment or heavy-mineral-concentrate sample locality. Organic sample media for the Circle quadrangle include willow leaves.

Sample Collection

Stream-sediment samples consist of active alluvium collected from first-order (unbranched) and second-order (below the junction of two first-order) streams as shown on USGS topographic maps (scale ≈ 1:63,360). Each sample was composited from several localities within a 100-ft radius of the sample site. Heavy-mineral concentrates were collected in conjunction with stream sediment sampling by panning sediment at the sample site. No details are available for the soil and organic samples collected.

Sample Preparation

The stream-sediment samples were air dried, then sieved through an 80-mesh (0.17 mm) stainless-steel sieve. The minus-80-mesh fraction was saved for analysis. Moss-trap-sediment samples were screened and the organic material separated by flotation. After oven drying, the sediment was sieved using 30-mesh (0.50 mm) and 80-mesh (0.17 mm) stainless-steel sieves. Both the minus-30-mesh to plus-80-mesh and the minus-80-mesh fractions were saved for analysis. Sieve size fraction information is recorded in the data tables.

Some stream-sediment samples were prepared with an oxalic-acid leaching technique. The secondary iron and manganese oxides coating stream-sediment grains are scavenging agents that concentrate elements leached from bedrock and colluvium and migrating as free ions in solution. The oxide components are extracted from the minus-80-mesh fraction using a weak, hot oxalic-acid solution (Alminas and Mosier, 1976).

The heavy-mineral concentrates generally were sieved to minus-30 or minus-40 mesh. The sample was further separated with the heavy liquid bromoform into two fractions: a light-mineral fraction (specific gravity 2.86 or less) and a heavy-mineral fraction (specific gravity greater than 2.86). Following heavy-liquid separation, magnetite and other strongly magnetic minerals were removed from the heavy-mineral fraction by use of a hand magnet and a Frantz isodynamic magnetic separator set at 0.2 ampere and saved for analysis. The remaining fraction was again sent through the Frantz separator at a setting of 0.6 amperes and the non-magnetic fraction was retained for analysis.

The willow leaves initially were air dried in cloth bags. The leaves were then pulverized in a blender and ashed in a muffle furnace at a peak temperature of 500° C. The ash was saved for analysis.

Sample Analysis

The stream-sediment, heavy-mineral-concentrate, and both moss-trap-sediment samples were analyzed using a semiquantitative, direct-current arc emission spectrographic method (Grimes and Marranzino, 1968). Spectrographic results were determined by visually comparing spectra derived from the sample against spectra obtained from laboratory reference standards. Standard concentrations are geometrically spaced over any given order of magnitude of concentration such that values reported for each sample are reported in the geometric sequence 10, 15, 20, 30, 50, 70, 100 etc. The precision of the Grimes and Marranzino (1968) method is plus or minus one reporting interval at 83 percent, or two intervals at 96 percent confidence (Motooka and Grimes, 1976). The elements analyzed and their nominal limits of determination are listed in table 1.

Selected stream-sediment samples were analyzed for gold, copper, and lead by atomic-absorption methods (Ward and others, 1969). Ultraviolet fluorometry (modification of Centanni and others, 1956) was used to determine uranium in selected stream-sediment samples. Mercury was determined by a mercury-vapor detector developed by Vaughn and McCarthy (1964). The lower limits of determination for these elements in parts per million (ppm) are: gold, 0.05; copper, 5; lead, 5; uranium, 0.05; and mercury, 0.02.

Selected stream-sediment samples and the minus-80 fraction of the moss-trap-sediment samples were analyzed for arsenic, bismuth, cadmium, antimony, and zinc by atomic-absorption spectrometry (O'Leary and Viets, 1986). The lower limits of determination for these elements in parts per million are: arsenic, 5 or 10; bismuth, 1; cadmium, 0.1; antimony, 2; and zinc, 5.

The heavy-mineral concentrates and oxide residues were analyzed by the Grimes and Marranzino (1968) emission spectrographic procedure as described above, with the following modification: to eliminate the spectral interferences caused by high concentrations of iron, 5 mg of prepared sample was used instead of 10 mg, thus raising the lower limit of determination by two steps (Table 1).

Selected heavy-mineral-concentrate samples were analyzed for the six platinum group elements (PGE) by fire-assay/ICP mass spectrographic analysis. The lower limits of determination for these elements in parts per million are: platinum, 0.0005; palladium, 0.0008; rhodium, 0.0005; ruthenium, 0.0005, osmium, 0.001; and iridium, 0.0005.

Selected heavy-mineral-concentrate samples were analyzed for silver, bismuth, cadmium, copper, cobalt, nickel, lead, and zinc by atomic absorption (modification of Nakagawa, 1975). Gold, indium, and thallium contents were determined by atomic absorption (modification of Hubert and Lakin, 1973). The lower limits of determination for these elements in parts per million are: silver, 0.2; bismuth, 5; cadmium, 0.2; copper, 1; cobalt, 1; nickel, 1; lead, 5; zinc, 1; gold, 0.2; indium, 0.2; thallium, 0.2. Selected magnetic concentrates were measured to determine equivalent uranium. The radiation of each magnetic concentrate was reported as percent equivalent uranium and the lower limit of determination is 0.003 percent (Pan and others, 1980).

The ashed willow leaves were analyzed by a semiquantitative, direct-current arc emission spectrographic method developed by Mosier (1972) for the analysis of plant ash.

DESCRIPTION OF DATA

Sample description, geologic, and analytical data are presented in each of the sample media files. Sample site locations are given as latitude and longitude both in decimal degree and degree-minute-second formats in the tables. The following list summarizes table structure and sample description column headings. For table structures, "A8" refers to an alphanumeric format eight characters wide, while "N" indicates a numeric column format. Sample description code explanations are listed in Appendix A.

Table Structure	Column Identifier	Description
A6	Jobnum	assigned laboratory job number
A7	Labnum	assigned sample laboratory number
A8	Fieldnum	sample field identification number
A8	Date_sub	date sample submitted to laboratory
A20	Submitter	submitter name
A20	Subm2	secondary submitter name
A9	Lat_dms	latitude in degree-minute-second
A11	Lon_dms	longitude in degree-minute-second
N	D_lat	latitude in decimal degrees
N	D_lon	longitude in decimal degrees
A2	LL_precis	latitude/longitude precision
A1	St	type of sample media
A1	Mc	method sample collected
A1	Sc	sample source
A1	Rt	rock type
A1	Ga	geologic age
A2	Ms	mesh/sieve code
A2	Sd	additional sample description information
A2	Sd3	additional sample description information
A2	Sd4	additional sample description information
A2	Sd5	additional sample description information
A2	Sp1	sample lab preparation information
A2	Sp2	sample lab preparation information
A2	Sp3	sample lab preparation information
A2	Cm	lab/submitter comments

Chemical data follows the above sample description information in the data files. The chemical data are accurate to two significant digits. Trailing zeros are nonsignificant. Columns in which the element headings

contain the prefix "S" represent emission-spectrographic data. The prefix "Aa" indicates atomic absorption analyses; "Inst" indicates instrumental method (fluorometric or mercury-vapor); the prefix "As" indicates fire-assay/ICP-MS; and "Samp_wt" indicates sample weight in grams for fire assay analyses for PGE. The suffix "p" indicates a partial digestion; "t" indicates a total digestion; and "sw" indicates sample weight in grams. The column heading "Equiv_u" indicates percent equivalent uranium. The results for all elements are reported in parts per million (ppm) except for iron, magnesium, calcium, titanium, sodium, and phosphorus, which are given in percent (pct).

Definitions of the qualifier codes used in the tables are as follows: B, sample not analyzed for this element; N, not detected at the specified level of detection; L, detected, but below the specified limit of determination; G, greater than the specified upper limit of determination; and H, values not determined due to interference.

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Table 1.--Limits of determination for Emission Spectrographic Analysis
Numbers in () were limits before 1988

Elements	Sediments		Concentrates	
	Lower limit	Upper limit	Lower limit	Upper limit
	Percent			
Iron (Fe)	.05	20	.1	50
Magnesium (Mg)	.02	10	.05	20
Calcium (Ca)	.05	20	.1	50
Sodium (Na)	.2	5	.5	10
Titanium (Ti)	.002	1	.005	2
Phosphorus (P)	.2	5	.5	10
	Parts per million			
Silver (Ag)	.5	5,000	1.0	10,000
Arsenic (As)	200	10,000	500	20,000
Gold (Au)	10	500	20	1,000
Boron (B)	10	2,000	20	5,000
Barium (Ba)	20	5,000	50	10,000
Beryllium (Be)	1	1,000	2	2,000
Bismuth (Bi)	10	1,000	20	2,000
Cadmium (Cd)	20	500	50	1,000
Cobalt (Co)	(5) 10	2,000	(10) 20	5,000
Chromium (Cr)	(5) 10	5,000	(10) 20	10,000
Copper (Cu)	5	20,000	10	50,000
Gallium (Ga)	5	500	10	1,000
Germanium (Ge)	10	100	20	200
Indium (In)	2	--	--	--
Lanthanum (La)	(20) 50	1,000	(50) 100	2,000
Lithium (Li)	200	--	--	--
Manganese (Mn)	10	5,000	20	10,000
Molybdenum (Mo)	5	2,000	10	5,000
Niobium (Nb)	(10) 20	2,000	(20) 50	5,000
Nickel (Ni)	5	5,000	10	10,000
Lead (Pb)	10	20,000	20	50,000
Palladium (Pd)	--	--	5	1,000
Platinum (Pt)	--	--	20	1,000
Antimony (Sb)	100	10,000	200	20,000
Scandium (Sc)	5	100	10	200
Tin (Sn)	10	1,000	20	2,000
Strontium (Sr)	100	5,000	200	10,000
Thorium (Th)	100	2,000	200	5,000
Thallium (Tl)	2	--	--	--
Vanadium (V)	10	10,000	20	20,000
Tungsten (W)	(50) 20	10,000	(100) 50	20,000
Yttrium (Y)	10	2,000	20	5,000
Zinc (Zn)	200	10,000	500	20,000
Zirconium (Zr)	10	1,000	20	2,000

APPENDIX A
Explanation of sample description codes

Sample Type (St)

A rock
B unconsolidated sediment
C organic material
D soil
E water
F other
G gas

Method collected (Mc)

A single (grab)
B composite
C channel
D other

Sample source (Sc)

A outcrop
B mine
C dump or prospect pit
D float
E drill hole, well
F marine
G other
H stream
I spring
J lake
K aquaduct, canal, irr. ditch
L atmosphere

Rock type (Rt)

A unidentified rock
B sedimentary rock
C metamorphic rock
D igneous rock
E unconsolidated sediment
F conglomerate
G sandstone
H siltstone
I claystone
J shale
K limestone or dolomite
L carbonate
M gneiss
N schist
O quartzite
P marble
Q skarn
R phyllite or slate
S felsic igneous
T intermediate igneous
U mafic igneous
V ultramafic igneous
W feldspathoidal
X chert or jasperoid
Y other

Geologic age of sample (Ga)

A	Precambrian undifferentiated
B	Early Precambrian
C	Middle Precambrian
D	Late Precambrian
E	Paleozoic undifferentiated
F	Cambrian
G	Ordovician
H	Silurian
I	Devonian
J	Mississippian
K	Pennsylvanian
L	Permian
M	Mesozoic undifferentiated
N	Triassic
P	Jurassic
Q	Cretaceous
R	Tertiary undifferentiated
S	Paleocene
T	Eocene
U	Oligocene
V	Miocene
W	Pliocene
X	Quaternary undifferentiated
Y	Pleistocene
Z	Holocene

Mesh/sieve fraction (Ms)

A	unknown, assumed to be -80 mesh
B	identified as -80 mesh
C	identified as -100 mesh
D	identified as -120 mesh
E	identified as -150 mesh
F	identified as -200 mesh
G	identified as -60 mesh
H	identified as -40 mesh
I	identified as -35 mesh
J	identified as -30 mesh
K	identified as -24 mesh
L	identified as -20 mesh
M	identified as -30+80 mesh

Sample description (Sd)

AL	alluvium
AS	ash
CL	clay
CV	colluvium
C	pan or artificial concentrate
C1	concentrate, high magnetic fraction
C2	concentrate, moderately magnetic fraction
C3	concentrate, low or non-magnetic fraction
GV	gravel
GT	grit
HS	heavy sand
LO	loess
MD	mud
OZ	ooze
SN	sand
SD	stream sediment
SI	silt
TI	till

Sample description (Sd3)

AN	animal parts
CS	combined splits of heavy-mineral-concentrate
DM	detrital magnetites
MS	splits of magnetites
NS	non-magnetic splits from heavy-mineral-concentrate
OA	oxalic acid leachate
VG	vegetation

Sample description (Sd4)

GD	glacial debris
MT	moss-trap-sediment sample
PT	peat material
SP	spruce

Sample description (Sd5)

MI	mill tailings
MT	moose pellets
WL	willow leaves

Sample preparation (Sp1)

AD	ashed
BR	bromoform
GR	ground

Sample preparation (Sp2)

FR	Frantz isodynamic separator
PV	pulverized

Sample preparation (Sp3)

FS fire assay PGE
HG hand ground
HM separated by hand magnet
RT split into red tops

Lab/submitter comments (Cm)

HG high organic content
RS rock/soil survey
VG visible gold

Lat/lon precision (LL_precis)

A apparently accurate to nearest second
B apparently accurate to nearest minute
C apparently accurate to nearest degree